March 24, 2008

Alan Taylor
Regulatory Compliance
Chemtura Corporation
Benson Road 2-19
Middlebury, CT 06749

Dear Mr. Taylor:

The Office of Pollution Prevention and Toxics is transmitting EPA's comments on the robust summaries and test plan for Barium Stearate, posted on the ChemRTK HPV Challenge Program Web site on February 6, 2006. I commend Chemtura Corporation for its commitment to the HPV Challenge Program.

EPA reviews test plans and robust summaries to determine whether the reported data and test plans will provide the data necessary to adequately characterize each SIDS endpoint. On its Challenge Web site, EPA has provided guidance for determining the adequacy of data and preparing test plans used to prioritize chemicals for further work.

EPA will post this letter and the enclosed comments on the HPV Challenge Web site within the next few days. As noted in the comments, we ask that Chemtura Corporation advise the Agency, within 60 days of this posting on the Web site, of any modifications to its submission. Please send any electronic revisions or comments to the following e-mail addresses: oppt.ncic@epa.gov and chem.rtk@epa.gov.

If you have any questions about this response, please contact me at 202-564-8617. Submit questions about the HPV Challenge Program through the "Contact Us" link on the HPV Challenge Program Web site pages or through the TSCA Assistance Information Service (TSCA Hotline) at (202) 554-1404. The TSCA Hotline can also be reached by e-mail at tsca-hotline@epa.gov.

I thank you for your submission and look forward to your continued participation in the HPV Challenge Program.

Sincerely,

/s/

Mark W. Townsend, Chief
HPV Chemicals Branch

Enclosure

cc: O. Hernandez
R. Lee
J. Willis

EPA Comments on Chemical RTK HPV Challenge Submission:
Barium Stearate

Summary of EPA Comments

The sponsor, Chemtura Corporation, submitted a complete test plan and robust summaries to EPA for Barium Stearate (CAS No. 6865-35-6) dated December 22, 2005. EPA posted the submission on the ChemRTK HPV Challenge Web site on February 6, 2006. Data for four supporting chemicals were also submitted: barium (CAS No. 7440-39-3), barium sulfate (CAS No. 7727-43-7), barium chloride (CAS No. 10361-37-2), and stearic acid (CAS No. 57-11-4).

EPA has reviewed this submission and has reached the following conclusions:

1. Analog Justification. The submitter needs to expand the discussion with study details on the dissociation of barium stearate to support the use of analog data for many endpoints. The inclusion of barium metal as an analog is unexplained and unsupported and is ignored in these comments; all references to barium metal need to be deleted from the submission.

2. Physical Chemical Properties. Adequate data are available for the boiling point, vapor pressure, partition coefficient, and water solubility endpoints for the purposes of the HPV Challenge program. The submitted melting point data are inadequate; additional information is needed to support the value.

3. Environmental Fate. Adequate data are available for the photodegradation and fugacity endpoints for the purposes of the HPV Challenge program. For biodegradation, the submitter needs to improve the analog justification, show that barium ion does not affect the biodegradation of the stearate anion, and enhance the summaries with adequate details. For stability in water, the submitter needs to provide sufficient information to support the postulated ready dissociation of the salt.

4. Health Effects. Adequate data were submitted for the acute toxicity endpoint for the purposes of the HPV Challenge program. EPA reserves judgment on the genetic, repeated-dose and reproductive/ developmental toxicity endpoints pending further justification for the use of analog data. The submitter needs to address deficiencies in the robust summaries.

5. Ecological Effects. EPA reserves judgment for these endpoints pending the submission of adequate support for the use of the proposed analogs.

EPA requests that the submitter advise the Agency within 60 days of any modifications to its submission.

EPA Comments on the Barium Stearate Challenge Submission

General

EPA addressed the issues raised by the dissociation of metal carboxylates on the HPV Challenge website in detailed comments to the Metal Carboxylates Coalition. These comments can be viewed at http://www.epa.gov/chemrtk/pubs/summaries/metalcarb/c14172tc.htm. In general, the dissociation of metal carboxylates needs to be supported by data on the stability and dissociation of the metal-ligand pair, and not only with data on the acid dissociation constant (pKa).

At the beginning of section 3.0 the test plan states that barium stearate "readily dissociates from an ion pair into free metal and free acid." This is not possible. Throughout the ensuing paragraphs the terms "metal" and "free metal" appear where "metal ion" would be expected. The language needs to be corrected.

Analog Justification

The submitter proposes to use data for four chemicals: barium (CAS No. 7440-39-3), barium sulfate (CAS No. 7727-43-7), barium chloride (CAS No. 10361-37-2), and stearic acid (CAS No. 57-11-4) to fill data gaps for the sponsored substance. These analogs were chosen to represent the dissociation products of barium stearate. Barium metal is not a dissociation product of barium stearate, cannot serve as an analog of a barium salt, and will not be discussed further in these comments. All references to elemental barium need to be deleted from the test plan.

The submitter cites dissociation studies on barium stearate to support using data for the dissociation products. The test plan cites a "dissociation constant", variously stated to be the pKa, pKb, or pKa1, of 6.706 (test plan section 3.0). The value is attributed to Lezotte and Nixon (2002), but no experimental details of the measurement of this value appear in either the test plan or the robust summaries. The submitter appears to regard this value as a pKa and claims that it indicates substantial dissociation of barium stearate (CAS No. 6865-35-6) at neutral pH, with complete dissociation at gastric pH (pH 1.2). The use of the analog data needs to be further supported by providing data from the cited study, in particular, the stability constant of the sponsored substance if available. Without an adequate robust summary, EPA cannot evaluate the submitter's claims as to dissociation, but offers the following comments on the issue.

The submitter asserts that the pKa of 6.706 "indicates that in the neutral pH range, significant portions of the metal carboxylate will be dissociated", dissociation increasing with decreasing pH. Barium stearate dissociation may increase with decreasing pH but the reported dissociation constant cannot be used to determine the degree of dissociation of the salt as a function of pH. The submitter needs to provide details on the methodology of the dissociation study because test methods designed to determine pKa (e.g., OECD TG 112) do not measure useful information about the dissociation of metal carboxylates (dissociation constants can be measured using potentiometric titration, whereas pKa is measured by titration of an acid against a base). By definition, a pKa describes *only* the dissociation of a single proton from an acidic molecule; therefore, a measured pKa is not an appropriate measurement of the dissociation behavior of salts of this type and does not provide useful information for the sponsored compound, such as whether the sponsored material will dissociate at environmentally relevant pH values. The dissociation of a monovalent ligand from a divalent cation is a stepwise process, and each step has its own dissociation constant. Although these equilibria are influenced by pH, the pH cannot be correlated with the degree of dissociation of a metal carboxylate salt on the basis of a pKa value alone.

Furthermore, because barium has a larger and more accessible coordination sphere than does a proton, barium can coordinate a variety of ligands, including water molecules and other dissolved ions. Depending on the ligands present, additional reactions are possible, such as deprotonation of a water molecule that is coordinated to the metal. The submitter needs to recognize the distinction between these concepts, and account for the diversity of equilibria present in aqueous solution.

For the human health endpoints, the use of data for barium chloride, barium sulfate and stearic acid is reasonable if barium stearate readily dissociates. However, undissociated, the stearic acid moiety of barium stearate may contribute to its membrane permeability where subsequent metabolism may release the metal ion. There is evidence to suggest that barium ions contribute to hypokalemia and the displacement of calcium ions (ATSDR 1992). The submitter needs to address this aspect of the potential toxicity of barium stearate in the absence of further support for the ready dissociation of barium stearate.

Similarly, for ecological endpoints, the submitter needs to supply more information to adequately support the proposed degree of dissociation of the salt and thus the use of analog data.

Test Plan

Physical chemical properties (melting point, boiling point, vapor pressure, partition coefficient and water solubility)

Adequate data are available for boiling point, vapor pressure, partition coefficient, and water solubility for the purposes of the HPV Challenge program. Although the modeled values should be used with caution because the estimation program is designed to handle neutral organics, they are consistent with the ranges expected for metal carboxylates.

Melting Point. The melting point data provided by the submitter were from an incompletely cited reference and no substantiating data were found in the literature. Without an adequate citation, or corroborating literature data, the accuracy of the submitted melting point data cannot be determined.

Environmental Fate (photodegradation, stability in water, biodegradation, fugacity)

Adequate data are available for photodegradation and fugacity for the purposes of the HPV Challenge program.

Photodegradation. Barium stearate is expected to exist in the atmosphere as particles, not in the vapor phase; the photodegradation model thus does not apply.

Stability in water. The sponsored substance does not contain hydrolyzable functional groups and hydrolysis testing is not necessary. However, the test plan does not provide sufficient information to characterize the postulated ready dissociation of the salt, the concept that is relied upon to support use of data on the dissociation products (see above under Analog Justification). The submitter needs to clearly identify the nature of the "dissociation study", supply an adequate robust summary, and show how the results support the proposed testing approach.

Biodegradation. The submitter provided biodegradation data for stearic acid but none for barium stearate. The test plan states that because barium stearate is expected to dissociate into the metal cation and the stearate anion in water, biodegradation data obtained from stearic acid should adequately represent the degradation of barium stearate. On that basis, if given adequate support as discussed above, the data provided by the submitter may be adequate for the endpoint. However, the submitter would also need to show that barium ion does not affect the biodegradation of the stearate anion. In addition, the test plan text and Table 3 state that barium compounds are not expected to be readily biodegradable; yet stearic acid is stated to be readily biodegradable and to represent the endpoint for barium stearate. The submitter needs to resolve this confusion. Finally, the summaries lack adequate details.

Health Effects (acute toxicity, repeated-dose toxicity, genetic toxicity, and reproductive/developmental toxicity)

Adequate data were submitted for the acute toxicity endpoint. EPA reserves judgment on the genetic, repeated-dose and reproductive/developmental toxicity endpoints pending further justification of the use of analog data. The submitter needs to address deficiencies in the robust summaries.

Ecological Effects (fish, invertebrates, and algae)

No experimental data were available for barium stearate to address ecological effects. As discussed above, the submitter's analog approach for barium stearate is not adequately supported. EPA reserves judgment for these endpoints until the deficiencies are addressed.

Specific Comments on the Robust Summaries

In general, the robust summaries for physical chemical properties and environmental fate lacked adequate experimental detail.

Environmental Fate

Biodegradation. The summaries needs to include a description of the method or experimental parameters such as the test substance purity and concentration, inoculum type and concentration, positive and negative controls, temperature, and analytical technique.

Stability in water. A robust summary is needed for the cited dissociation study.

Health Effects

Acute Toxicity. The robust summaries were prepared from secondary sources. The submitter should attempt to retrieve additional information from the original references. If the original references are unavailable, the Klimisch code should be changed to 4 (unassignable) and the information used in a weight-of-evidence approach to address the acute toxicity endpoint.

Followup Activity

EPA requests that the submitter advise the Agency within 60 days of any modifications to its submission.

Reference

ATSDR, U.S. Department of Public Health (1992) Toxicological Profile for Barium and its Compounds.